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doctrine in question is the basis of every system of logic in existence, and necessarily so.

Jevons was perhaps a little too apt to present his thoughts to the public before he had given them time to mature, and hence some of his theories are crude and but half worked out. Indeed, he seems in some cases to have been aware of this himself; for he writes to one of his correspondents about the 'Principles of science,' in the following terms: "To the want of a psychological analysis of the basis of reasoning I plead guilty. . . . No doubt, to a considerable extent I have avoided the true difficulties of the subject; but this does not preclude me from attempting to remedy the defect at some future time, if I live long enough, and can feel that I see my way to a more settled state of opinion" (p. 322). But, unfortunately for him and for us, he did not live long enough to finish this and other tasks that he had projected; and it is sad to think how much the world may have lost by the death, at the age of forty-six, of a man of such freshness of thought, and courage of opinion, as Jevons undoubtedly showed.

THE RAILWAYS AND THE REPUBLIC.

CAN competition be so arranged as to prevent the more serious abuses of railroad power? Can it be made to apply to railroads as it does to most other lines of business? Fifty years' experience has seemed to show that it cannot. Mr. Hudson believes that it can; and he makes out a case which will appear plausible to those who are not in a position to understand the practical difficulties involved in his project.

Each year's history shows that under our existing system—or want of system—railroad managers wield an irresponsible power, dangerous alike to shippers and to the government. By arbitrary differences in charge they can ruin the business of individuals; by political corruption they can often thwart all attempts at government control. The history of the Standard oil company, which Mr. Hudson tells extremely well, furnishes an instance of both these things. The railroads made a series of contracts with the company to do its business at much lower rates than they would give to any one else; while the railroads and the company together were able to set at naught the plainest principles of common law, to defy legislative investigation, and laugh at state authority itself.

What is to be done under these circumstances? This is the question to which Mr. Hudson addresses himself. He does not fall into the extreme of

advocating state ownership. He has too strong a sense of the dangers of government management to believe that political corruption could be avoided, or enlightened economy secured, by a measure like this. Admitting, then, that railways are to remain under private ownership, how are their abuses to be brought under control? Almost every writer has his own notion on the subject, and his own individual shade of opinion; but we may group them under three main heads:—

1. There is one class of writers who insist that things are well enough as they are; who say that the reduction in rates under our present system has been so great, and the development of the country so rapid, as to outweigh any incidental evils which may exist. They say that the most we can possibly think of doing is to prohibit a few of the worst abuses, and perhaps secure a very moderate amount of publicity; and that other things will take care of themselves. This is the position of writers like Stuart Patterson or Gerritt Lansing.

2. Many of the more enlightened railroad men, like Albert Fink, G. R. Blanchard, or Charles Francis Adams, jun., do not deny the existence of most serious evils; but they attribute them to unrestricted competition, which favors competing points at the expense of local points, or places solvent roads at the mercy of bankrupt ones. They favor legalizing pools, and limiting the irresponsible construction of new roads, and think that the public interest would be best served by a responsible combination of railroads, with a commission to see that the interests of the shippers were not neglected.

3. On the other hand, Mr. Hudson insists that we have, not too much competition, but too little; that the abuses incident to its partial and irregular working can be best avoided by enabling it to act everywhere instead of nowhere. This he proposes to do by allowing others besides the railway company to use the track, on payment of a just and reasonable toll. He argues strongly to prove that this plan is not merely equitable, but practicable, and that each of the other positions is wrong, both in fact and in morals.

He has no difficulty in breaking down the arguments of the first group. The men who insist that railroad management is a private business, with which there should be no interference, and that all is well enough as it is, are every day becoming fewer. The really difficult conflict is against those who admit the evils, but who say that the remedy is to be found in well-controlled combination rather than uncontrolled competition. Mr. Hudson insists that combinations perpetrate outrages which individual roads could not perpe-

trate, and that the worst abuses of railroad wars have their origin in the desire to force rival roads to a combination. Against the first of these points we may cite the testimony of Mr. Sterne, — certainly no prejudiced witness, — that the actual abuses have been lessened rather than increased when the trunk-line pool was in operation. We may cite the uniform experience of Europe, that only where pooling contracts were made permanent has it been possible to bring discrimination under control; so that men as widely distinct in their views as Gladstone and Bismarck have both sanctioned the system by their active countenance. With regard to the motive for railroad wars, we may show that it is regularly the weaker party who is the aggressor, rather than the stronger party. And finally, as a counter-argument against Mr. Hudson, it may be shown that his scheme has been found impracticable. It was tried and abandoned at the outset, as he himself admits. Every subsequent change in railroad administration has rendered the difficulties of its application greater instead of less. Both by theory and by experience, it may be shown that the attempt to treat the railway as a public highway has done some harm and no good in the past, and must grow even less possible with the increasing complication of railroad business.

OPPOLZER'S TREATISE ON ORBITS.

OPPOLZER'S treatise on the determination of the orbits of planets and comets is so well and so favorably known to students of astronomy, that, in calling attention to the French translation of the first volume (which will be found welcome by those who do not read German with ease), we might have confined ourselves to the briefest notice, if the translator had reproduced the German edition without modification. M. Pasquier has, however, introduced, together with several minor changes, the mode of counting longitude and time recommended by the Washington international meridian congress of 1884: that is, longitudes east from Greenwich are regarded as plus, and west as minus; and the astronomical day is made to begin with mean midnight. This innovation is in accord with the ideas of Dr. Oppolzer, who is known as one of the strongest and most distinguished of the advocates of the new plan. M. Pasquier says that the change has been made in response, also, to the wishes of the majority of astronomers and of governments. It is difficult to see upon what ground such a conclusion is drawn in regard to the wishes

of astronomers; the opinions published during the past year are far from indicating a majority in favor of the change; and diplomatic action, even if ratified by the countries represented, can scarcely be expected to influence astronomers in such an important matter. The course adopted by M. Pasquier we are inclined to regard as somewhat premature, and it may interfere with the general acceptance and usefulness of the translation as a text-book; but he has taken care to indicate in his preface the corrections which must be made in the text and tables, if one prefers to reckon the astronomical day from mean noon (the present custom) instead of using universal time. To quote a recent comment, "a glance at these corrections will show astronomers some of the troubles that are in store for them, should they make the change which the Washington conference has recommended."

The typography of the volume is good (we are always sorry, though, to meet with the flat-topped figure three (3), an abomination when it is found on divided circles and micrometer heads, and scarcely more legible in print), and especial pains have been taken to insure accuracy in the tables and formulae. The tables, we are told, were revised three times while the work was going through the press.

THE fourth volume of the 'Publications of the Washburn observatory,' which we have just received, seems to bring to a close the work undertaken at Madison by Professor Holden. The greater part of the volume is taken up with the work of the Repsold meridian circle for 1884 and 1885, — the observation of the 303 stars which are to serve as reference-points for the southern zones of the *Astronomische gesellschaft*. A casual glance shows a satisfactory performance of the instrument; but we regret with Professor Holden, that, under the circumstances, it has been possible to give merely the "results of observation, instead of accompanying them with the thorough discussion they seem to deserve." We note particularly the creditable part taken in both observations and reductions by Miss Alice Lamb, who appears in the *personnel* as one of the 'assistant astronomers.' A valuable piece of astronomical bibliography will be found in the seven pages devoted to a reference-list of the original sources from which errata have been taken in systematically correcting the star-catalogues contained in the observatory library. Some thirty pages are occupied with the results of meteorological observations; and a brief discussion is given of a longitude campaign undertaken, in co-operation with a government surveying party, to determine the western boundary of Dakota.

Traité de la détermination des orbites des comètes et des planètes. Par THEODORE D'OPPOLZER. Tr. by Ernest Pasquier. Vol. i. Paris, Gauthier-Villars, 1886. 4°.